



**MODEL ANSWER**

**SUMMER- 17 EXAMINATION**

**Subject Title: Automobile Air Conditioning**

Subject Code: **17620**

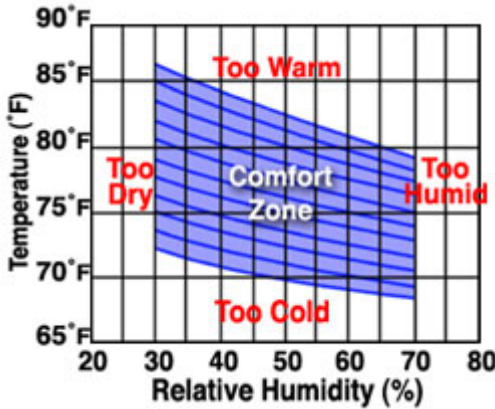
**Important Instructions to examiners:**

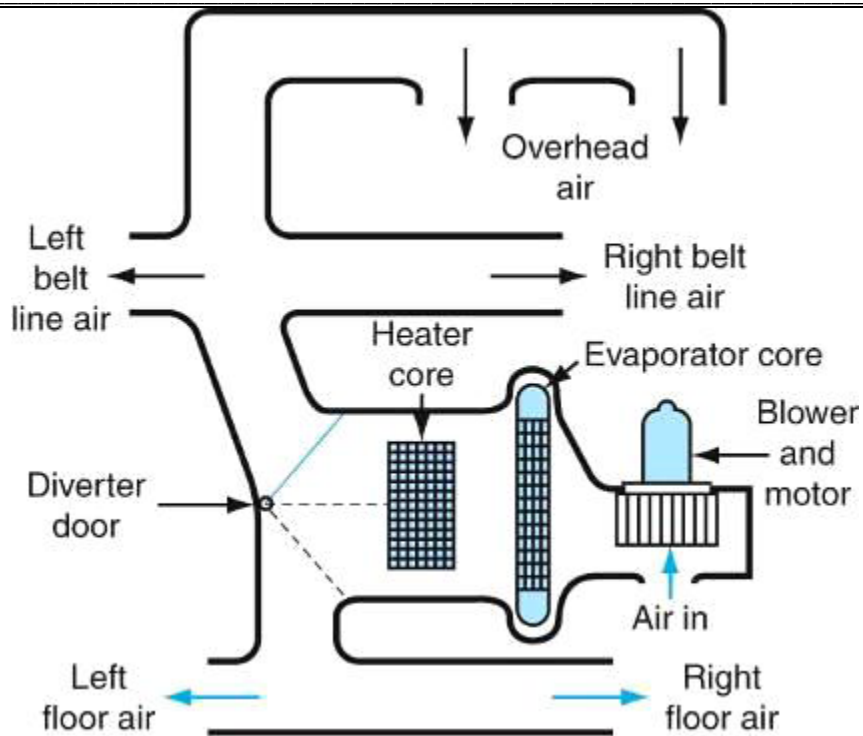
- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
Q.1	A)	Attempt any three of the following	12
	a)	<b>What are the basic requirements for designing the HVAC in car?</b>	04
		(Any four points) The main requirements that must be considered in car air-conditioning system design include. <ol style="list-style-type: none"><li>1. Occupancy data</li><li>2. Dimensions and optical properties of glass</li><li>3. Outside weather conditions</li><li>4. Dimensions and thermal properties of materials in car body</li></ol>	04
	b)	<b>Enlist different types of duct system used in air distribution</b>	04
		(Any four points) Different types of duct systems used in air distribution are <ol style="list-style-type: none"><li>1. Independent case system with upstream blower.</li></ol>	04



		2. Independent case system with downstream blower. 3. Split case system. 4. Hybrid case system.	
	c)	<b>State desirable properties of refrigerant used in air conditioning.</b>	04
		<b>Desirable Properties of a Good Refrigerant:</b> <i>(Any four properties- 1 mark each)</i> <b>1) Thermodynamic Properties:-</b> a) It should have Low Boiling Point. b) It should be below the evaporator temperature. c) It should be above atmospheric pressure. d) It should have low condensing pressure. e) It should have high latent heat of vaporization. f) It should be above the condensing temperature & pressure. <b>Chemical Properties:-</b> a) It should not be Poisonous or injurious. It should not be non-irritating to eyes. b) It should not be corrosive & should not have any effect on materials used in equipment. c) It should have fewer tendencies to leak & if it is leaking it should be easily detectable. d) It should not be Inflammable. <b>4) Other Properties:-</b> a) It should be easy & safe to handle. b) It should be readily available at low cost. c) It should have high COP & low power requirement.	04
	d)	<b>d) Explain in brief working of low pressure switch</b>	04
		<b>Low pressure switch:</b> <b>Working:</b> It is located in the low side of air conditioning system, usually on accumulator. This switch is normally closed and opens when low side pressure drops below 13.8-55.2kPa. It	

		provides data to processor to disengage compressor clutch circuit to prevent compressor operation during low pressure conditions. Low pressure condition may result due to loss of refrigerant or clogged orifice tube.	04
Q.1	B)	Attempt any one.	06
	a)	<b>Define human comfort zone. Show comfort zone on Psychometric chart</b>	06
		<p>There is a range of combined temperatures and humidities that provides comfort to most people. This Comfort Zone Chart shows "Indoor Air Temperature" on the vertical axis, "Relative Humidity" on the horizontal axis, and a shaded area known as the "Comfort Zone."</p> 	02  04
	b)	<b>Explain with block diagram working of rear heating and cooling system</b>	06
		<p><b>Rear heating system:</b> Some trucks and vans are equipped with rear air distribution system to provide rear heating. A schematic sketch of rear heating system is as shown in figure. Depending on design it may have major components; blower and motor, temperature door, evaporator core with metering device, heater core with flow control, outlet mode door, control panel, and controller. In this system second heater core is located at the rear of passenger compartment. Driver controls overall operation. Some system allows the rear passenger to control the temperature. For control of rear blower switch is provided at the front or at rear or sometimes at both places. In this system rear blower forces the air into the second heater core from where heated air enters into the distribution section and finally delivered to the rear compartment.</p>	02



02

## 2. Rear Cooling system:

Some trucks and vans are equipped with rear air distribution system to provide rear cooling. A schematic sketch of rear cooling system is as shown in following figure. Depending on design it may have following major components; blower and motor, temperature door, evaporator core with metering device, heater core with flow control, outlet mode door, control panel, and controller.

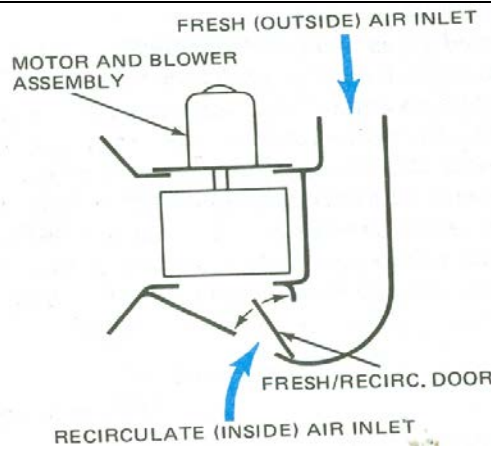
In this system second evaporator core is located at the rear of passenger compartment. Driver controls overall operation. Some systems allow the rear passenger to control the temperature.

02

For control of rear blower switch is provided at the front or at rear or sometimes at both places. In this system rear blower forces the air into the second evaporator core from where cooled air enters into the distribution section and finally delivered to the rear compartment



Q.2		Attempt any four																									
	a)	<b>Differentiate between controlled and uncontrolled ventilation. (Any four points)</b>	04																								
		<table border="1"><thead><tr><th>Sr.No.</th><th>Controlled Ventilation</th><th>Uncontrolled Ventilation</th></tr></thead><tbody><tr><td>01</td><td>Forward movement of car and blower motor forces or rams air through the ducts and into the car.</td><td>Uncontrolled ventilation occurs when anyone opens window so that air can enter.</td></tr><tr><td>02</td><td>The air from outside enters the vehicle through openings in front grill.</td><td>The air from outside enters the vehicle through window.</td></tr><tr><td>03</td><td>This system does not provides any quantity of fresh air quickly</td><td>This system provides any quantity of fresh air quickly</td></tr><tr><td>04</td><td>This system does not allow wind, rain, dust and other airborne particles to enter inside the vehicle.</td><td>This system allows wind, rain, dust and other airborne particles to enter inside the vehicle.</td></tr><tr><td>05</td><td>Currently this method of ventilation is used in vehicles.</td><td>This method has been used for years</td></tr><tr><td>06</td><td>The entry of air is controlled by suitable valves or doors.</td><td>The entry of air is not controlled by suitable valves or doors.</td></tr><tr><td>07</td><td>This system includes heater and air conditioning system</td><td>This system does not include heater and air conditioner system.</td></tr></tbody></table>	Sr.No.	Controlled Ventilation	Uncontrolled Ventilation	01	Forward movement of car and blower motor forces or rams air through the ducts and into the car.	Uncontrolled ventilation occurs when anyone opens window so that air can enter.	02	The air from outside enters the vehicle through openings in front grill.	The air from outside enters the vehicle through window.	03	This system does not provides any quantity of fresh air quickly	This system provides any quantity of fresh air quickly	04	This system does not allow wind, rain, dust and other airborne particles to enter inside the vehicle.	This system allows wind, rain, dust and other airborne particles to enter inside the vehicle.	05	Currently this method of ventilation is used in vehicles.	This method has been used for years	06	The entry of air is controlled by suitable valves or doors.	The entry of air is not controlled by suitable valves or doors.	07	This system includes heater and air conditioning system	This system does not include heater and air conditioner system.	04
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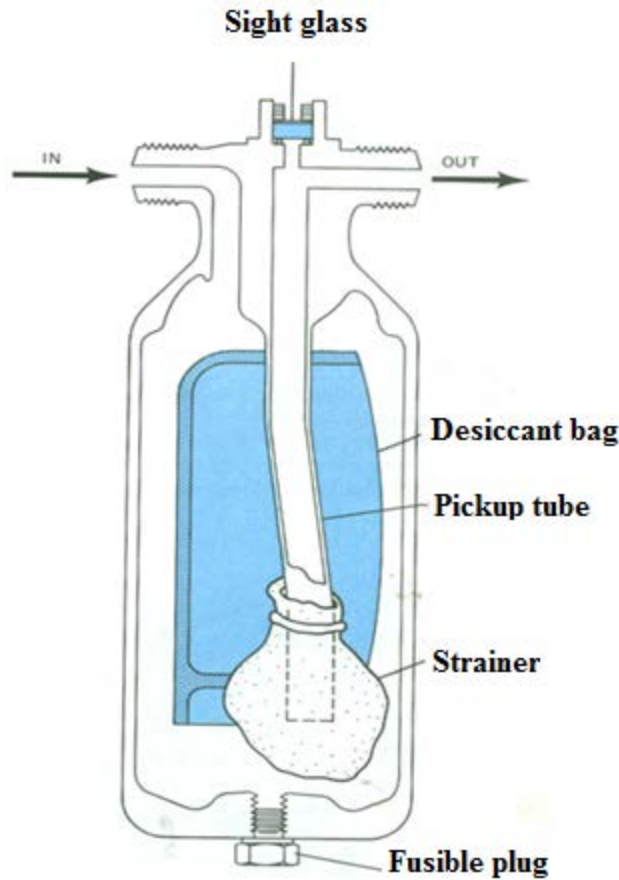
	<p>b) <b>Explain construction of air intake section with neat sketch.</b></p>	04
	<div data-bbox="633 241 1120 693" data-label="Diagram">  </div> <p>Above figure shows schematic sketch of air intake or inlet section. It consists of fresh (outside) air inlet; re circulates (inside) air inlet, a fresh re circulates air door, a blower with motor, and an air outlet. The fresh air inlet provides the system with fresh outside air supply; the re- circulate air inlet provides re circulated in-car air supply.</p> <p>The position of vacuum motor operated fresh/re circulate door depends on system mode. Actually in all modes except maximum cooling, the air supply is from outside. In maximum cooling, the air supply is from inside. Even in the maximum cooling mode, some systems provide for up to 20% fresh air. This is to provide for a slightly positive in-car pressure</p>	02

c) **State the function of drier. Explain with neat sketch.**

04

**Function:** The function of drier is to absorb moisture from the refrigerant with the help of drying agent. This agent, which is usually in the form of a silica gel, is known as "desiccant."

02



02

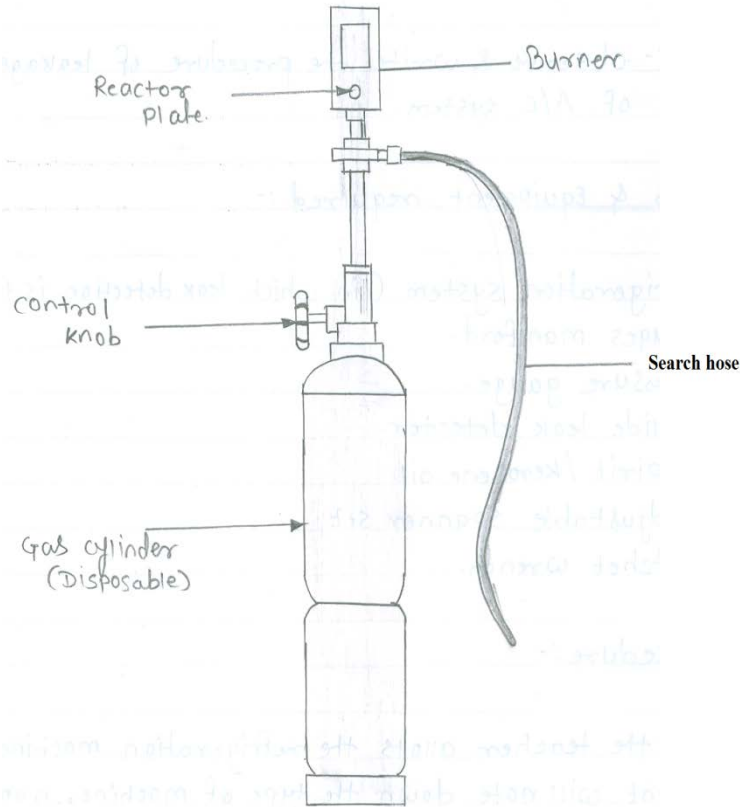
**Figure: Receiver/Drier**

A screen is placed in the receiver/drier to catch and prevent the circulation of any debris that may be in the system. The receiver or drier is a cylindrical metal can with two fittings and in most cases, a sight glass. The drier is located in the high pressure side of the air conditioning system. In general, the construction of receiver/drier is such that refrigerant vapor and liquid are separated to insure that 100% liquid is fed to the thermostatic expansion valve. The assembly can be divided into two parts: the receiver and the drier. The receiver section of the tank is storage compartment. This section holds the proper amount of extra refrigerant required by the system to insure proper operation. The receiver insures that a steady flow of liquid refrigerant can be supplied to the thermostatic expansion valve. The drier section of the tank is simply a bag of desiccant, such as silica gel, that can absorb and hold small quantity of moisture.



	<p>d) <b>Explain working of sun load sensor with sketch.</b></p>	02
	<p><b>Construction:</b> The sun load sensor is a photochemical diode (PCD) located on top of the dashboard. This sensor send signal to the electrical climate control module (ECCM) indicating the strength of the sunlight (sun load) which influences the vehicle interior temperature.</p> <p><b>Working:</b> If the sun load is high as signaled by the sun load sensor the ECCM will activate the highest lower fan speed and max cooling to compensate for this additional radiated heat load. Likewise if the sun load is low (cloud cover) as sensed by the sun load sensor the ECCM will reduced the blower fan speed and the system will not operate at max cooling.</p>	02
	<p>e) <b>Enlist different leak detection methods. Explain in brief any one of them</b></p>	04
	<p>Different leak detection methods are</p> <ul style="list-style-type: none"> <li>a) Halide leak detection method</li> <li>b) Fluroscnt leak detection method</li> <li>c) Nitrogen leak detection method</li> </ul> <p><b>Halide Leak Detection Method:</b></p> <p>Halide leak detector as shown in figure can detect a leak as slight as 0.4536kg in ten years. This instrument is popular because of its low initial cost, ease of handling and simplicity in construction and operation. It consists of two major parts; the detector unit and the gas cylinder. The gas cylinder is a non refillable pressure tank containing a gas such as propane or butane. The detector unit consists of valve, the burner and the search hose.</p> <p>After igniting the gas and air mixture, the flow of gas is regulated until the flame burns about 6mm above the opening in the reactor plate. The plate is heated by flame to red hot temperature. When search hose comes into contact with leaking refrigerant, the refrigerant is drawn into the search tube and is brought to the receiver plate, where different colour flames are produced. in the burner. If the flame colour is blue, there is no leak, if the flame colour is yellow-green the leak is small, if the flame colour is bright blue purple the leak is large. If the leakage is severe, the flame is put out.</p>	02              (An y one met hod  02)





**Fluorescent Detection Method:** The user adds a small amount of fluorescent dye into the air conditioning system, and then allows the dye to circulate throughout the system. Wherever the refrigerant escapes, so does the dye.

Although the refrigerant evaporates, the dye remains at the sites of all leaks. When the system is scanned with a high-intensity ultraviolet or UV/blue light lamp, the dye glows bright yellow to pinpoint the precise location of every leak.

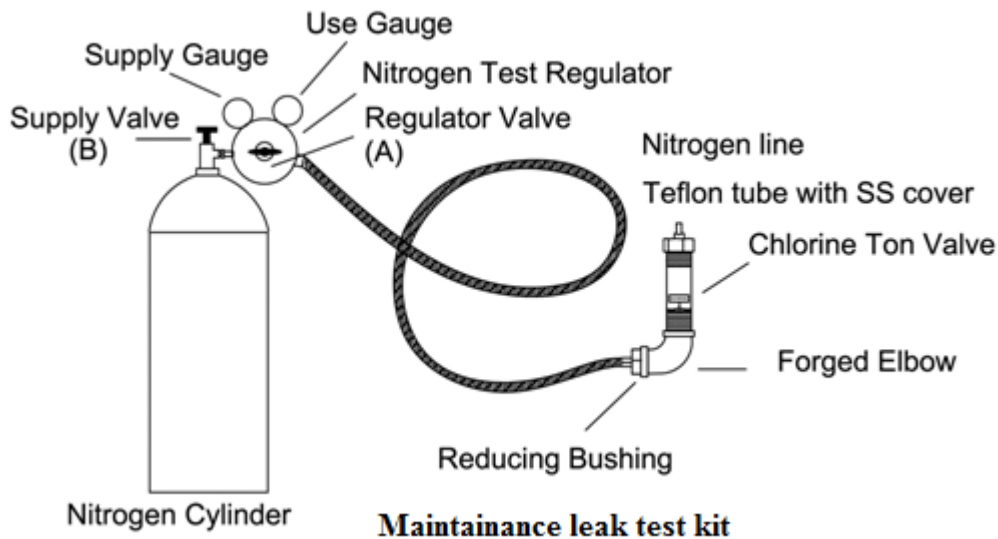
This method cuts refrigerant expenses because we find leaks while they are very small. And since we find the leaks so quickly, our labor costs have been reduced considerably.” This method reduces inspection time by 75 percent or more. This leak detection method is so accurate that it locates the smallest, most elusive leaks in tubing, soldered joints, fittings, coils, valves, compressors, and more.

### **Nitrogen Detection Method:**

#### **Nitrogen Leak test – Regulator Operations:**

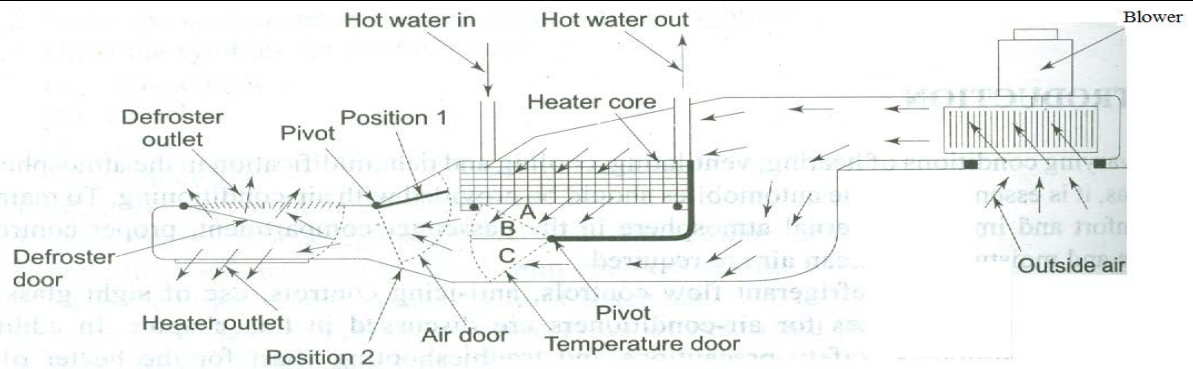
1. Turn valve A on regulator counter clockwise until loose.
2. Open valve B on nitrogen cylinder, supply gauge will read 2000/2200lb when full

3. Turn valve B on regulator r clockwise until gauge reads 175lbs
4. Close valve B on nitrogen cylinder.
5. Turn valve A on regulator clockwise until pressure reading on use gauge stops rising. This will usually be between 200- 250lbs. this will also cause the reading on supply gauge to drop to 200-250lbs.
6. The system is now in test mode and any leak will cause the use gauge to drop.



f) **What is comfort heating system**

04



**Figure:Heating System**

The above figure shows car heater system. The heater core is a small radiator, much like an engine radiator. Hot coolant from engine is circulated through this heater core by means of engine water pump. This heats the heater core. Air from the outside flows through the heater core air passages. This heats the air.

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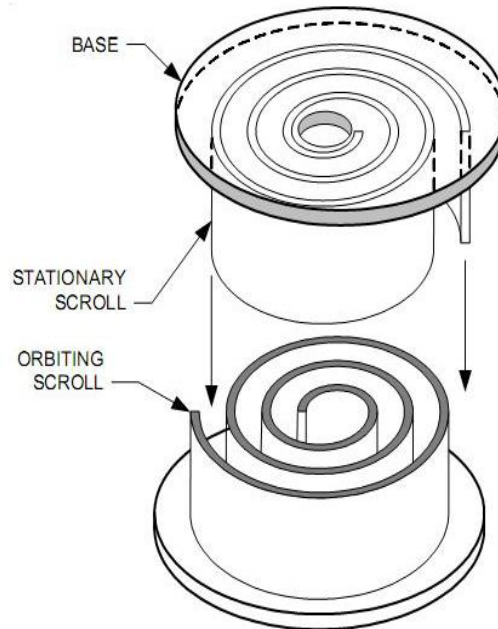


		<p>This heating system has three doors.</p> <ol style="list-style-type: none"><li>1. The temperature door can be moved to permit more or less air to flow through the heater core.</li><li>2. The air door can be operated to allow full air flow or no air flow, or any position in between.</li><li>3. The defroster door can be moved to project the heated air on the inside of windshield or to the outlet of the heater in the car.</li></ol> <p>All these doors are operated manually by control levers or knobs on the instrument panel.</p>	
3		Attempt Any two	16
	a)	State the environmental and safety aspects in automobile air conditioning. Explain in detail with example.	08
		<p><b>Answer:-</b></p> <p>Environmental aspects--(any4)</p> <ol style="list-style-type: none"><li>1. To avoid ozone depletion we can replace CFC-12 by HFC-134a.</li><li>2. In HVAC system less CO<sub>2</sub> released.</li><li>3. Emissions to air: emissions like smoke, dust, odour, and fumes from automobile HVAC should be minimum. Efforts must be taken to avoid these emissions.</li><li>4. Vibrations and Noise: HVAC adds number of components; fuel cost is more in operating HVAC.</li></ol> <p>In vehicle vibrations and sound developed due to friction and shocks. Proper use of dampers and shock resistant is used to avoid vibration and sound. it will affect environment.</p> <p>Safety aspects-(any4)</p> <ol style="list-style-type: none"><li>1. Always wear eye protection when servicing air conditioning system or handling refrigerants.</li><li>2. Avoid breathing refrigerant and lubricant vapour or missed.</li><li>3. Do not allow refrigerant to come in contact with open flames and high temp surfaces.</li><li>4. Service equipments should not be pressure tested or leak tested with compressed air.</li></ol>	08
	b)	Explain with net sketch the construction of scroll type compressor.	08
		<p><b>Answer:-</b>Construction of scroll type compressor:</p> <p>Constructional features of scroll type compressors are as shown in the figure. It consists of refrigerant temperature sensor, moveable scroll, delivery port, intake port, low pressure service valve, front plate, needle bearing, stud pin, crankshaft, eccentric bushing, ball coupling, and fixed</p>	04

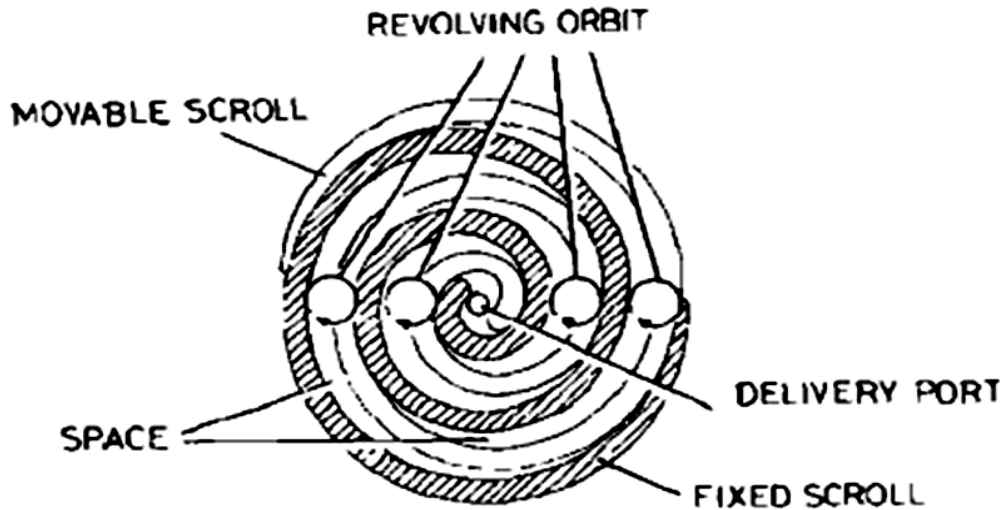
scroll etc.

Figure: Scroll compressor

Scroll-type compressors have two metal scrolls, one fixed and one moveable, which provide an eccentric motion. As the compressor shaft rotates, an eccentric bushing on the shaft drives the moveable scroll, and refrigerant is forced against the fixed scroll, and towards its center. The motion creates an increase in pressure toward the center of the scroll. The refrigerant vapor moves in a circular pattern, and its pressure is increased as it moves toward the center of the scroll. The high pressure refrigerant is released through a delivery port located at the center of the scroll. Scroll-type compressors provide a longer effective compression stroke, and a smoother start-up than other compressor designs, and they produce less vibration.



OR



c) What are the various faults, causes and their remedies if compressor is not starting in car air conditioning? 08

**Answer: (Any four)(2 marks each)**

Sr.No	Fault	Causes	Remedies
1	Noise in compressor	Loose Components	Tightening
		Lack of oil	Replenish the oil level and check the bearings
		Piston	Check debris on piston
		Loose floor mounting	Tightening of bolts
2	Compressor not working	Broken belt	Replace belt
		Broken clutch wire	Repair wire
		Bad thermostat	Repair thermostat
		Bad clutch coil	Repair
3	Low Compressor discharge pressure	Leakage system	Repair leakage
		Defective expansion valve	Repair valve
		Suction valve closed	Open it
4	High compressor discharge pressure	Air in system	Recharge system
		Clogged condenser	Clean condenser
		Discharge valve closed	Open valve

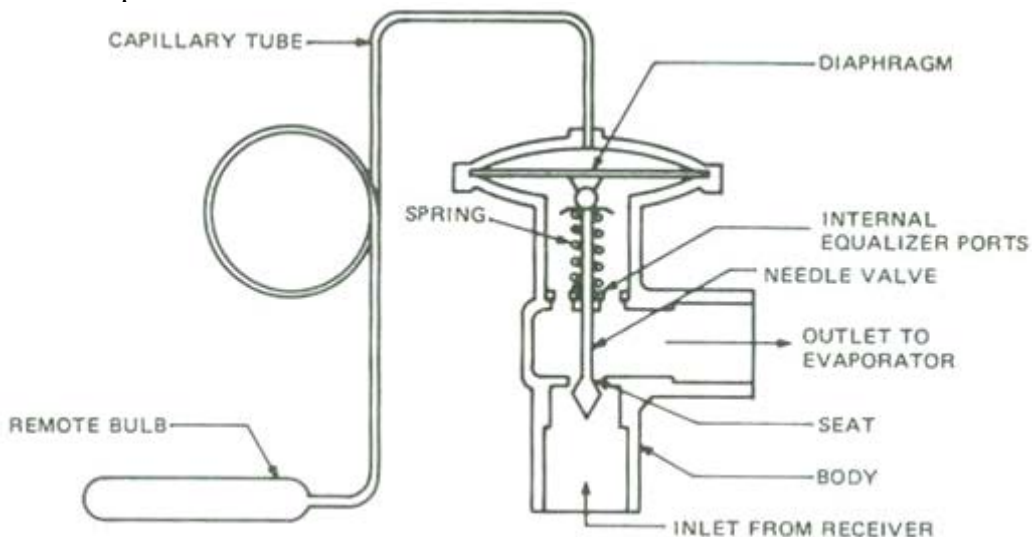
5	Low suction pressure	Refrigerant shortage	Add refrigerant
		Worn compressor piston	Replace compressor
		Compressor suction valve leaking	Change valve
6	High suction pressure	Loose expansion valve	Tighten valve
		Overcharged system	Remove some refrigerant
		Expansion valve stack open	Replace expansion valve

4      A)      Attempt any three      12

a)      Explain the working of thermostatic expansion valve with neat sketch      04

The capillary tube, tube end and upper diaphragm chamber form a closed system filled with a temperature sensing gas. (Refrigerant- carbon dioxide, similar gas). The capillary remote bulb is clamped on to the evaporator outlet pipe and it is insulated from the outside air with special tape and it measures only the temperature of refrigerant, as it leaves the evaporator. Any increased in refrigerant temp. at the evaporator outlet increase the pressure in the remote bulb & tube system. This exerts downward pressure on the diaphragm is greater than the combination of the evaporator pressure & the superheat spring pressure, as a result valve is open and increase flow of refrigerant to evaporator coil.

As the temp. of refrigerant decrease, it decreases pressure in the remote bulb and tube system. This decreases pressure on the diaphragm & this pressure less than combination of evaporator pressure and superheat spring pressure and allowing the valve tube close and control flow of refrigerant to the evaporator coil.



02

<b>Figure Thermostatic Expansion Valve</b>		
b)	Enlist various metering device used in Automobile air conditioning	04
	<p><b>Answer:(2 marks each)</b></p> <p><b>a)thermostatic expansion valve-1) internal equalized type2) external equalized type</b></p> <p><b>b) orifice tube</b></p>	
c)	State the function of i) in car temperature sensor ii) Time delay relay	04
	<p><b>Answer:-In-car temp. sensor:</b></p> <p>In car temp sensor located in aspirator &amp; n its function is to monitor car in side temp continually.</p> <div style="text-align: center;"> <p>Fig:- In car temp sensor</p> </div> <p><b>Time Delay Relay:</b> The time delay control unit is designed to prevent the heat cycle from coming on in the automatic unit until the engine coolant has reached temperature of 43.34oC. The unit consists of two resistors, capacitors, and transistors. Following figure shows time delay circuit of the wiring diagram.</p> <div style="text-align: center;"> <p>Figure: Time delay relay</p> </div>	02
d)	Explain in detail the moisture removal procedure from automobile air conditioning	04
	<p><b>Answer: -</b> Liquid refrigerant enters through the inlet. Any dirt is filtered by the filter pads and moisture is absorbed from the refrigerant by the desiccant. Any refrigerant vapor that does not</p>	02

liquefy in the condenser, is trapped and held until it condenses. Finally, clean and dry liquid refrigerant leaves the receiver dehydrator and goes to expansion valve. Evaporator also helps in dehumidification, as warmer air travels through the aluminum fins of cooler evaporator coil, the moisture content in the air condenses on its surface.

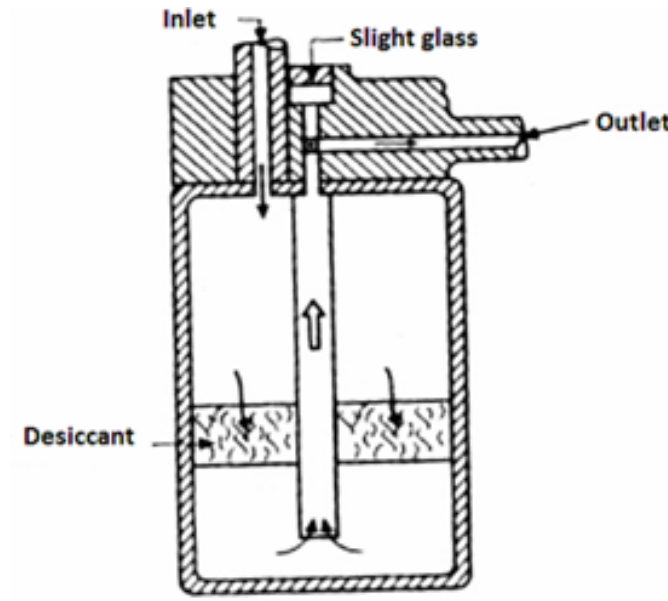


Fig:- Moisture control by receiver drier

02

B) Attempt ant one

06

a) Explain the working of remote bulb with neat sketch

06

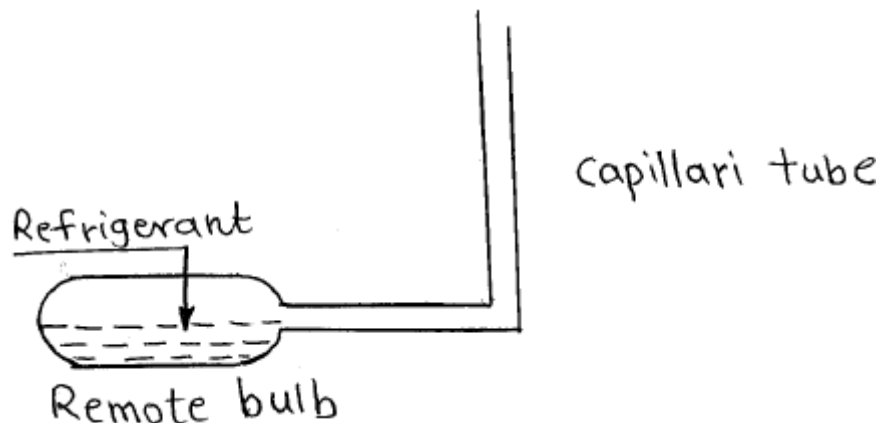
**Answer:-**

**working of remote bulb:**

Figure shows remote bulb. One end of capillary tube is connected to remote bulb and other end is connected to thermostatic expansion valve. A remote bulb filled with refrigerant same like refrigerant in A/C system. It is located at evaporator outlet. It maintains pressure on diaphragm against evaporator pressure and spring pressure.

As temperature of refrigerant at the outlet of evaporator increases, the temperature in the remote bulb also increases and get vaporized and vapour exerts pressure on diaphragm and diaphragm get open.

03



03

Figure: Remote bulb



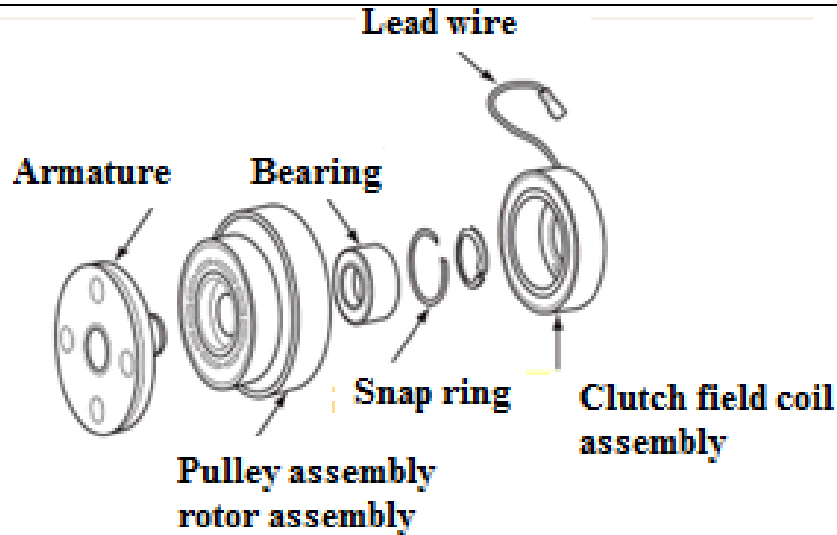
	b)	State the function of following components i) vacuum restrictor ii) check relay	06
		<p>Answer:- ( 03- marks each)</p> <p><b>i) Vacuum restrictor:</b> vacuum restrictor restrict vacuum when the engine turn off &amp; store vacuum in tank/reservoir. It prevents leakage of vacuum.</p> <p><b>ii) Check Relay:</b> It prevents vacuum loss during low manifold vacuum conditions and maintain the sufficient vacuum in the system mode operations during these periods</p>	
5		Attempt <b>any TWO</b>	16
	a)	Draw general layout of 'Automotive Air Conditioning System 'and show all the components & explain its working	08
		<p>Following are the basic components in every automobile air conditioning system.</p> <ol style="list-style-type: none"> <li><b>1. Compressor:</b> It is used to compress vapour refrigerant coming from the evaporator and supply high pressure vapour refrigerant to condenser.</li> <li><b>2. Condenser:</b> The function of the condenser is to condense vapour refrigerant into liquid.</li> <li><b>3. Expansion valve:</b> The function of expansion valve is to meter and control the flow rate of liquid refrigerant and reduce the temperature of liquid refrigerant.</li> <li><b>4. Evaporator:</b> The function of the evaporator is to give refrigerant effect by exchanging heat to</li> </ol>	04

the liquid refrigerant.

**5. Accumulator or receiver drier:** The receiver drier act as storage tank for the liquid refrigerant and also absorbs the moisture from the refrigerant.

b) Explain with neat sketch the construction of 'Electromagnetic Switch'.

08



**Figure: Assembly of electromagnetic clutch**

**Construction**

The air conditioning compressor has an electromagnetic clutch that can engage or disengage the compressor pulley. The compressor pulley always turns when the engine is running, but the compressor only runs when the pulley is engaged to the compressor driving shaft. When this system is activated, current runs through the electromagnetic coil. The current attracts it to the armature plate. The strong magnetic pull draws the armature plate against the side of the turning pulley. This locks the pulley and the armature plate together; the armature plate drives the compressor. When the system is deactivated, and current stops running through the electromagnetic coil, flat springs pull the armature plate away from the pulley. The magnetic coil does not turn since its magnetism is transmitted through the pulley to the armature. The armature plate and hub assembly are fastened to the compressor drive shaft. When it's not driving the compressor, the clutch pulley turns on a double row of ball bearings

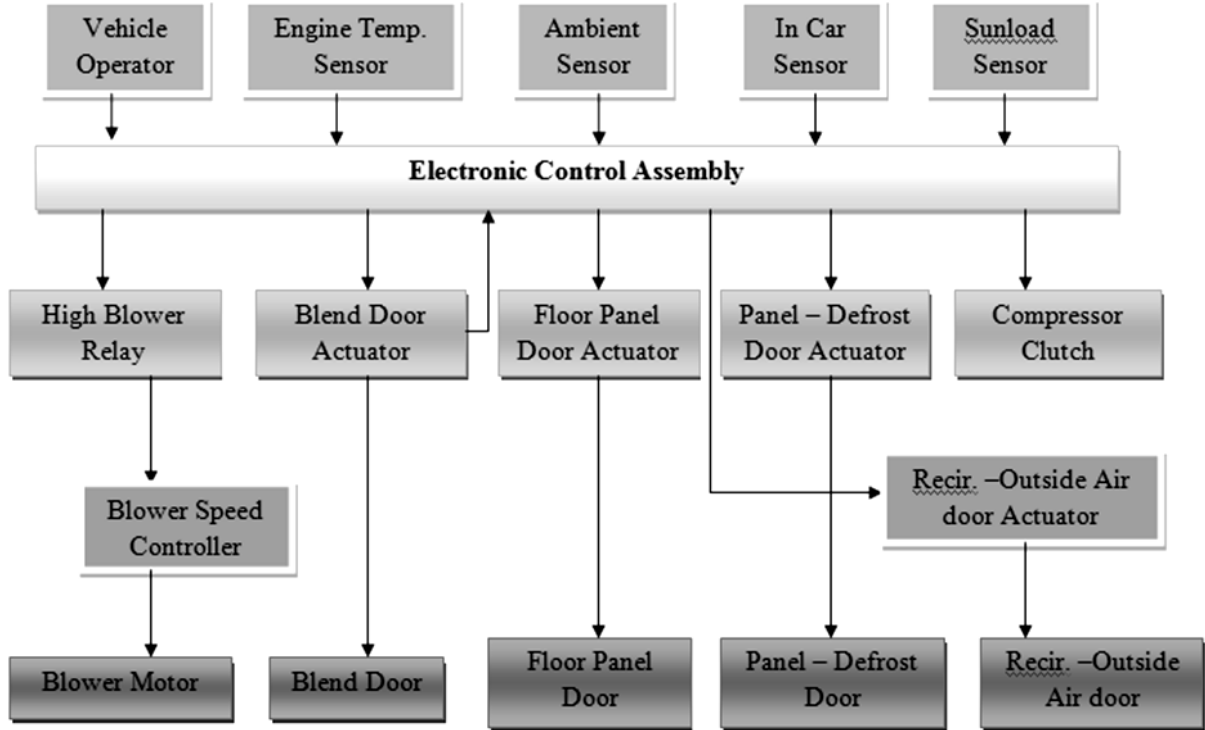
04

c) What is 'climate control'? Explain the working of electronic climate control with block diagram

08

**Climate Control:-** The electronic climate control (ECC) System offers automatic control of the front and rear rooftop air conditioners and furnace/s in the motor home. The system includes an energy management system that shuts off the air conditioners when necessary to prevent electrical over load. It also includes a number of features that provide the owner with the most comfortable temperature controlled environment possible.

02



**Figure: Electronic Temperature control system**

Working: An electronic temperature control system allows us to choose the temperatures we like. We first set our chosen temperature into the air conditioner control. The system will automatically adjust air temperature, mode (panel or floor), and blower speed to maintain the set temperature. Above figure shows block diagram of electronic automatic temperature control assembly. This assembly receives inputs from five major sources.

These are

1. Sun load sensor
2. In car sensor
3. Ambient temperature sensor
4. Engine temperature sensor
5. Vehicle operator

Using these inputs EATC control module determines the correct conditions for six outputs. These are four doors, blower motor and compressor clutch. An electric motor or actuator operates the temperature blend door. Vacuum motor operates the other three doors.

03

03

6) Attempt **any Four**

16

- a) State the function of
- i) Accumulator
  - ii) Receiver

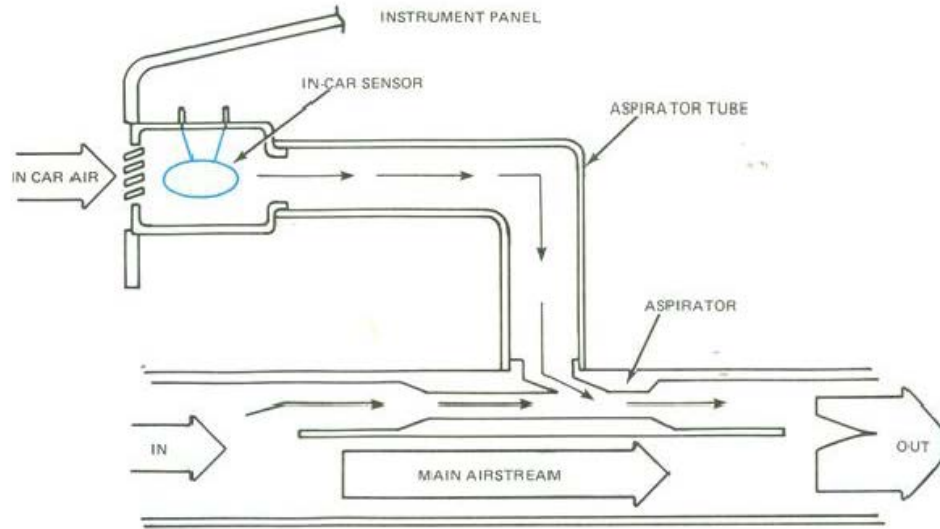
04

i) **Accumulator:**

02



	<p>The main functions of the accumulator are-</p> <p>a) To store excess refrigerant and</p> <p>b) Remove moisture from the system. If any liquid refrigerant is passed out of the evaporator it is stored by accumulator because liquid cannot be compressed. Liquid refrigerant can damage the compressor. Like the receiver drier the accumulator also uses desiccant to remove moisture from the system.</p> <p><b>ii) Receiver:-</b></p> <p>a) It maintain sufficient amount of refrigerant in system</p> <p>b) It condensate vapour refrigerant &amp; convert it into liquid refrigerant which further passes to thermostatic valve.</p> <p>It removes moisture, dust durt from liquid refrigerant.</p>	02
b)	<p>Enlist various types of switches used in automobile air conditioning system</p> <p>(Any 4 types of switches)</p> <p>i) Low pressure switch</p> <p>ii) High pressure switch</p> <p>iii) High pressure control switch</p> <p>iv) Superheat switch</p> <p>v) Low side temp switch</p> <p>High side temp switch</p>	04
c)	<p>What is 'Aspirator'? Explain its concept in brief</p>	04
	<p><b>Aspirator:</b> - The aspirator is small duct system which is so designed that it causes small amount of in car air to pass through it, as shown in figure. The main air stream causes low pressure at inlet end of the aspirator. This causes in-car air to be drawn into the in-car sensor plenum. The in-car sensor, located in plenum, is continuously exposed to average in- car air to monitor the in-car air temperature</p>	02



**Fig:- Concept of Aspirator**

02

d) State the use of 'vacuum pump'. Explain the procedure of vacuumisation with the vacuum pump

04

**Use of Vacuum Pump:-**Vacuum pump used to for evacuation ,to remove refrigerant, moisture & air from AC system

**Vacuumisation Procedure:-**The various components used in vacuum system are reserve tank; check valve, vacuum pump and vacuum motor. Connection for evacuation of system is shown in figure. Whenever opened, a/c system must be evacuated by using a vacuum pump. Connect low and high charging hoses of manifold gauge set respectively as follows-

02

Attach central charging hose of manifold gauge set to vacuum pump. Operate vacuum pump and then open suction side valve of manifold gauge set. If there is no blockage in the system, there will be an indication on high pressure gauge. When this occurs, open the other side valve of the set. Approximately 10 minute later, low pressure gauge should show a vacuum lower than 760 mm of Hg providing no leakage exists. Evacuation should be carried out for a total of at least 15 minutes. Continue evacuation until low pressure gauge indicates vacuum less than 760mm of Hg and then close both the valves. Stop vacuum pump, disconnect central charging hose from pump inlet. Now the system is ready for charging refrigerant.

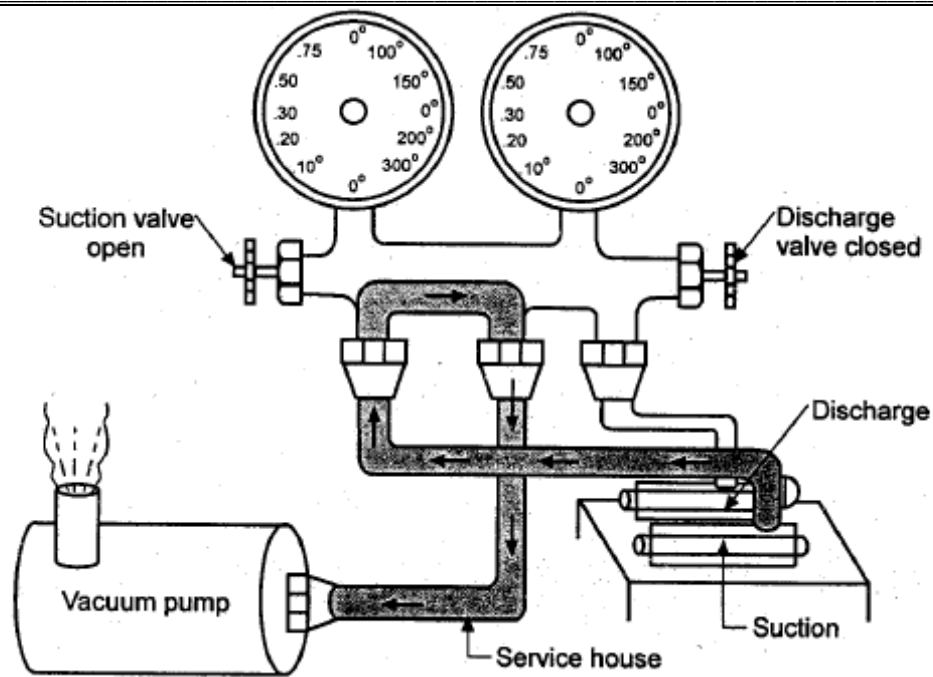


Fig:- Typical Vacuum System

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e) What do you mean by 'Visual Acoustic' check?

04

(Any 4 points)

1. Insufficient Cooling
2. Noise in compressor
3. Compressor not working
4. Low Compressor discharge pressure
5. High compressor discharge pressure
6. Low suction pressure
7. High suction pressure
8. Evaporator Pressure too High
9. Evaporator Pressure too Low

04

f) Enlist faults & remedies in comfort Heating System

04

(Any 2 points)

**Little or no heat:**

**Causes:**

- a. Air circulation not enough.
- b. Air in the heater core.
- c. Heat core is clogged
- d. Thermostat of engine cooling system is stuck open.

**Remedies:**

- a. Blower motor or switch is at fault. Temperature door or cable may be adjusted. Leakage of air from heater housing may be stopped.
- b. Bleed air out.
- c. Core should be repaired or replaced.

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d. Replace the thermostat.

**2. Defrosting insufficient:**

**Causes:**

a. Control cable of defrost door is out of adjustment.

b. Defrost outlets blocked.

**Remedies:**

a. Cable should be readjusted.

b. Remove the obstructions

02